Technology Opportunity

Light-Scattering Devices for Calibrating Droplet- and Particle-Measuring Instruments

The National Aeronautics and Space Administration (NASA) seeks to transfer light-scattering technology for rapidly and reliably calibrating droplet- and particle-measuring instruments.

Potential Commercial Uses

- Validity checks of droplet- and particle-measuring instruments
- Development of new devices that use light scattering
- Use with instruments for
  - Cloud physics studies
  - Aircraft icing research measurements
  - Industrial emissions measurement (droplets, smoke, etc.)
  - Spray characterization (fuel, paint, washers, etc.)

Benefits

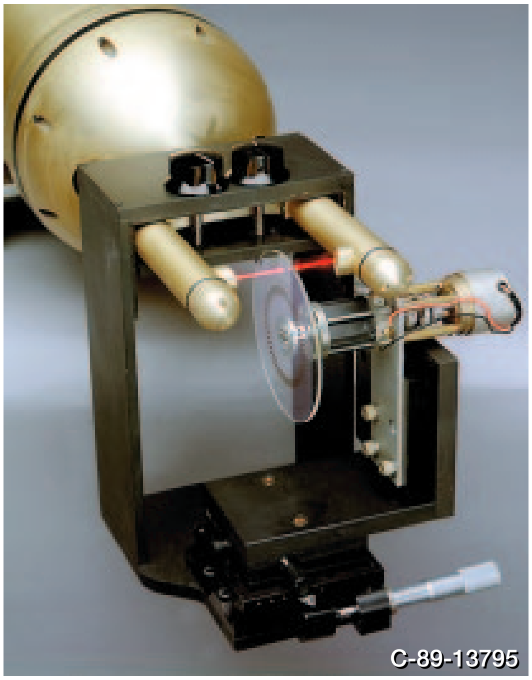
- Data quality improvement
- Less downtime
- Lower skill level required for validity check

The Technology

It is now possible to use light scattering to perform reliable, accurate in situ data validity checks on devices that measure droplets or particles. Data validity checks formerly requiring cumbersome, time-consuming, and often unreliable laboratory tests can now be performed any time with only a few minutes of setup time. Software developed at the NASA Lewis Research Center to model the light-scattering process provides the flexibility to adapt the technology to a variety of devices.

The technology has, to date, been used to develop in situ validity testing for three types of instruments: (1) devices that measure the shadow cast on a detector by a droplet or particle passing through a laser beam, (2) devices that measure light scattered at small angles relative to the path of the laser beam (called forward scattering) as a particle or droplet passes through the beam, and (3) devices that measure the light scattered from two crossed laser beams as a droplet passes through the space where the beams overlap.

For the shadow-detecting devices, Lewis has developed a rotating reticle, which is a glass disk with chrome spots deposited in tracks around the disk.



A rotating reticule is used to verify operation of a particle-sizing instrument, where size is determined by the shadow cast by the particle passing through a laser beam.

The disk is rotated so that a track of spots is in the measurement space of the device. These traveling spots emulate droplets passing through the measurement space. Because the spot sizes are fixed, the response of the device to the traveling track of spots is reliable and predictable. This device is in the applied stage of development.

For forward-scattering devices, Lewis has developed a rotating pinhole assembly that is placed in the measurement space of the device. The light scattering effects from the pinhole are repeatable and predictable. The predicted response of the device to this scattered light is used to validate the operation of the device. The rotating pinhole assembly is also in the applied stage.

For devices with two overlapping laser beams, Lewis is developing microlens reticles that consist of a microlens deposited on a glass substrate. When the microlens is placed in the space where the beams overlap, the light is scattered in a way that is both predictable and similar to the way that droplets affect light. As a result, the device responds with a consistent and repeatable output. This work is presently approaching the applied stage.

Options for Commercialization

A patent application is planned but has not been submitted. NASA Lewis seeks industrial partners to cooperatively develop additional applications for this technology.

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Key Words

Light scattering
Droplet sizing
Cloud physics
Mie scattering
Laser applications